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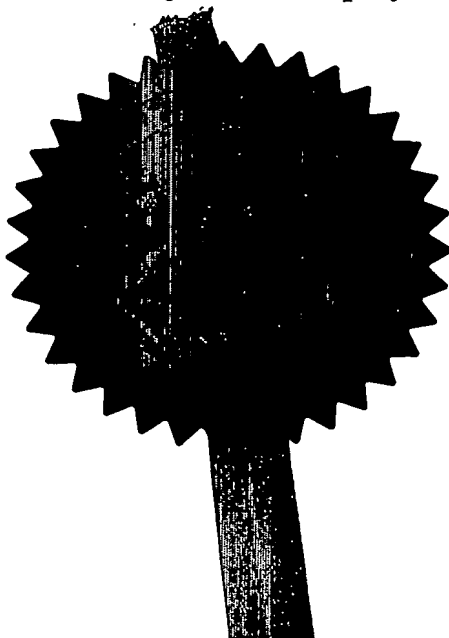
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1/77

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6.70.1032 UK

02DEC02 E767560-2 D00073

P01/7700 0.00-0227924.8

2. Patent application number

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0227924.8

3. Full name, address and postcode of the or of each applicant (underline all surnames)

INTERBREW S.A.
VARSTRAAT 94
B-3000 LEUVEN
BELGIUM

7906530002

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

A BELGIAN CORPORATION

4. Title of the invention

COOLING SYSTEM FOR ALCOHOL
BEVERAGE DISPENSING APPARATUS

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

G.F. REDFERN & CO.
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1412002

8435356001

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Country

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Number of earlier application

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Patents Form 1/77

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Description

11

Claim(s)

3

Abstract

1

Drawing(s)

4 + 4 SW

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Priority documents

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Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)

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11. I/We request the grant of a patent on the basis of this application.

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Date

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12. Name and daytime telephone number of person to contact in the United Kingdom

Mrs. S.M. Camp
01903 820466

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- 1 -

COOLING SYSTEM FOR ALCOHOL BEVERAGE DISPENSING APPARATUS

Field of the Invention

The present invention relates to a cooling system for use in an alcohol beverage dispensing apparatus and in particular, relates to a cooling system having a mediated thermal bridge for use in a home beer dispensing apparatus.

Background of the Invention

Beer dispensing apparatus are known in the art for dispensing of draft beer in taverns and the like. Typically, the beer is chilled prior to being dispensed by passing through a conical run of tube that passes through a chilled compartment containing ice and water. In some instances the compartment is refrigerated. Such draft beer dispensers are utilized in taverns where the large volumes of beer are dispensed everyday and the taverns have room to store such chillers. This is not the case for a domestic or home beer dispensing apparatus that is adapted to sit on a countertop in a kitchen where space is at a premium.

Further, due to limited countertop space requirements, there still is

a need to chill or cool the beer in the dispensing apparatus to serving temperatures in an optimal manner in spite of the limited space. Further, the quicker the beer is chilled to a desired serving temperature, the more useful the beer dispenser is to the consumer. Hence improvements in heat transfer capabilities within the dispensing apparatus are important features.

Summary of the Invention

It is an object of the present invention to provide an alcohol beverage or beer dispensing apparatus having a cooling system that is economical in its space requirements and enhances the extraction of heat from the beer.

The present invention relates to a cooling system for use with a alcohol beverage dispensing apparatus where the cooling system has a mediated thermal bridge having a banked latent cooling capacity provided by a cooling solution of water and glycol contained in the thermal bridge. The thermal bridge is arranged in thermal conducting relation between a keg containing the alcohol beverage and a cooling device which acts as an active heat sink. Preferably the mediate thermal bridge is a fully intermediated bridge in which all of the heat is transferred from the alcohol beverage to the cooling device, including the active heat sink, through the thermal bridge.

In accordance with an aspect of the present invention there is provided a cooling system for cooling a keg containing an alcohol beverage. The cooling system comprises a thermal bridge adapted to contact a surface portion of the keg. The thermal bridge has a reservoir or cavity filled with a cooling solution comprising a mixture of water and glycol. The cooling system further comprises a cooling device adapted to

chill the thermal bridge, including the cooling solution in the reservoir, so as to produce a latent heat cooling capacity in the thermal bridge for cooling the alcohol beverage contained in the keg when the keg is mounted in heat transfer relation with the thermal bridge.

The cooling solution preferably comprises 5% by volume glycol and freezes at a temperature below that of water providing an improved thermal bank. Further the cooling solution may contain anti-corroding particles to prevent or reduce the occurrence of corrosion in the thermal bridge. Preferably, the cooling solution is cooled to a temperature that forms ice. Preferably, the cooling device further includes an active heat sink adapted to remove heat produced by the cooling system as the cooling system cools the thermal bridge. The active heat sink is also adapted to dissipate heat transferred through the thermal bridge from the alcohol beverage in the keg.

Preferably the alcohol beverage is beer and the cooling system is utilized in a home beer dispensing apparatus.

Brief Description of The Drawings

For a better understanding of the nature and objects of the present invention reference may be had to the accompanying diagrammatic drawings in which:

Figure 1 is a front elevation view of a home beer dispensing apparatus in accordance with the present invention;

Figure 2 is a side elevation view of the home beer dispensing apparatus;

Figure 3 is an enlarged perspective view of the cooling system for the beer keg housed in the home beer dispensing apparatus illustrating the thermal bridge and its cavity;

Figure 4, is a perspective view of the top portion of the thermal bridge;

Figure 5 is a perspective view of the base portion of the thermal bridge showing the orientation of the base portion reversed relative to the orientation of the top portion shown in Figure 4;

Figure 6, is a cross sectional view of the cavity of the thermal bridge taken along section line VI-VI of Figure 3; and,

Figure 7 is a plan view of the heat sink and fan showing the horizontal air flow across the heat exchanger.

Detailed Description Of The Invention

Referring to Figures 1 and 2 there is shown a home beer dispensing apparatus, appliance or unit 10. The dispensing apparatus 10 is primarily intended for use in domestic kitchens but may also be used in utility rooms, garages, domestic bars, caravans etc. While the preferred embodiment relates to dispensing beer, alternatively carbonated solutions or other alcohol beverages may be dispensed by apparatus 10.

The home beer dispensing apparatus 10 has a front wall 12 and a dispensing tap 14 protruding forward of the front wall 12. A drip tray 16 also protrudes forward of the front wall 12 and is adapted to support an open glass container 18 below the dispensing tap 14. The home beer dispensing apparatus 10 further has a base 21 adapted to rest on a counter top. The front wall 12 is an extension of two pivoting side walls 20 which may be moved between closed and open positions to allow the keg 22 (see Figure 2 in broken lines) to be inserted into the housing of the home beer dispensing apparatus 10.

The housing of the home beer dispensing apparatus 10 further includes a top wall 24 and a rear wall 26. The rear wall 26 has a grill 30

that permits for air circulation within the home beer dispensing apparatus 10. An electrical cord 32 extends through the rear wall 26 of the apparatus 10 to provide a connection into a main electrical supply to supply electrical power to the electrical components housed within the unit 10. Alternatively, a 12 Volt DC supply input may be used.

The dispensing apparatus 10 has a cooling system 34 located behind and below keg 22 that is adapted to cool beer 70 in keg 22 when keg 22 is placed into dispensing apparatus 10. The dispensing apparatus 10 also dispenses the beer by providing a pressurised air supply (not shown).

Referring to Figure 3, the cooling system 34 is utilized to keep the beer in keg 22 at an ideal serving temperature for drinking.

The cooling system 34 has a Peltier thermoelectric device 36 that produces the necessary cooling effect. When a voltage is applied to the Peltier device 36 across leads 38 a thermal differential is generated across the Peltier device 36 which is used to cool a mediate thermal bridge 40. The Peltier thermoelectric device 36 provides a low continuous cooling rate along its cold side portion 60 to aluminum block 42 mounted to rear wall 70 of the thermal bridge 40.

To maximize the cooling power of the Peltier device 36, the hot side portion 44 of the Peltier device 36 is cooled by an active heat sink 46 coupled to the hot side portion 44. The heat sink 46, as seen in Figures 3 and 7, has a series of spaced apart horizontally extending fins or ribs 48 which extend along corresponding horizontal planes and across which air flows to cool the heat sink 46. The heat sink has a supporting wall 47 from which the heat exchange fins 48 extend to define two opposing lateral open sides 51, 53 and an open front 55.

A fan 50 is coupled to heat sink 46 against the open front 55 to blow ambient air passing through the grill 30 over the fins 48, out open sides 51, 53 and thereby make the heat sink 46 active. The fan 48 is positioned such that air is blown directly onto the face of the heat sink 46 as indicated by arrows 52 so as to maximize the turbulent air flow and the resultant heat dissipation from the heat sink occurs as the air flows horizontally out of the heat sink 46 between and across fins 48 as exemplified by air flow arrows 54. In Figure 7, a plan view of the heat sink 46 and fan 50 further illustrates the air flow 52 and 54 entering open front 55 and exiting opposing open sides 51, 53.

While vertical air flow across fins of a heat sink is considered a usual air flow path that takes advantage of the chimney effect of rising heat, the area within the dispensing apparatus 10 is filled with other component parts for the unit such as, for example, air pressure devices, the dispense tap, and possibly electronic hardware that should be kept at ambient temperature to operate effectively. In this environment, the chimney effect of a heat sink is detrimental to the operation and fitting of component parts in the fixed housing space of apparatus 10 and the operation of the horizontal air flow across heat sink 48 is beneficial.

As shown in Figure 1, the dispensing apparatus 10 has the grill 30 located in it's rear wall 26 through which air flow 52 into the apparatus 10 is drawn in by fan 50 and air flow out at 54 is achieved by horizontal extending fins 48 of the heat sink. The exit air flow 54 from grill 30 is shown to be above and below intake air flow 52 in Figure 1; however, in practice, the exiting air flow 54 is more to the side of input air flow 52. Hence the horizontal orientation of fins 48 of heat sink 46 result in an air flow in a direction away from component parts located above the heat

sink 46 within dispensing apparatus 10.

As mentioned, the cold side wall portion 60 of the Peltier device 36 is attached to the thermal bridge 40 through aluminum block 42. In the preferred embodiment, the thermal bridge 40 is aluminum and has an internal reservoir cavity 62 formed therein. The cavity 62 contains a cooling solution 66 (see Figure 6) of water and, preferably 5%, glycol. The cavity 62 provides a cooling bank and is cooled by Peltier device 36.

The bridge 40 has a cooling plate 64 upon which the keg 22 is located within the dispensing apparatus 10. The cooling plate 64 is located underneath the keg 22 so that the weight of the keg 22 is applied to the interface between the keg 22 and the cooling plate 64 thereby improving conductivity. The cooling at the bottom portion 68 of the keg 22 also ensures that beer to be drawn first, from the bottom of the keg, is cooled first. Cooling at the bottom portion 68 also permits insulation (not shown) around the top of the keg 22 to be thinner and less effective to allow cold air created inside the dispensing apparatus 10 to sink to the bottom portion 68.

It should be understood that the rate of cooling across the interface between keg 22 and cooling plate 64 is proportional to both the effectiveness of the interface contact between the two and the temperature differential between beer 70 housed in keg 22 and cooling plate 64.

Referring to Figures 4, 5 and 6, the assembly for the mediated thermal bridge 40 is shown. The mediated thermal bridge comprises cavity 62 filled with the cooling solution 66 (Figure 6) comprising a mixture of water and 5% glycol. This mixture improves cooling rate, whilst ensuring that the beer does not actually freeze. The freezing point of the water in the ice store is reduced by a couple of degrees by the

addition of the small amount of antifreeze or glycol. The cooling plate is now at 0°C rather than 2°C and the cooling rate of the beer increased. The cooling solution 66 effectively provides a bank of latent cooling capacity through cooling plate 64 to keg 22.

The ice store cavity 62 of the thermal bridge 40 preferably contains 1.5 liters of water and glycol mixture (5% glycol) and is permanently sealed. The 5% glycol allows freezing at -2°C. The glycol water mixture effectively increases the differential temperature between the beer and the cooling plate. The ice store mixture may also contain corrosion inhibitors.

The thermal bridge 40 comprises a top portion 72 (see Figure 4) comprising a top wall 74 and the cooling plate 64 beveled to receive the beveled bottom 68 of the keg 22. The top wall 74 has a series of spaced apart elongated fins 76 extending along and outwardly therefrom and interstitially into the cavity 62. The top portion 72 is adapted to sealingly engage side walls 78 of cavity bottom portion 80 (see Figure 5). Bottom portion 80 has a base wall 82 and a series of spaced apart elongated fins 84 that extend along and outwardly from base wall 82 and interstitially into cavity 62. Part 80 is filled with cooling solution 66 (Figure 6) and part 72 is sealed to part 80 to form cavity 62. Fins 76 of top portion 72 are inter spaced with and between fins 84 of lower portion 80 to provide an interleaved relationship when the thermal bridge 40 is assembled. The cooling solution 66 is positioned within cavity 62 located between fins 76 and 80 (see Figure 6). The cooling solution 66 boosts the cooling effect in cavity 62 between fins 76 and 84 due to additional latent heat capacity because water in the solution is frozen when sufficient cooling is provided by the Peltier device 36. The frozen water is a thermal bank.

When the keg 22 is put on cooling plate 64, the latent cooling, or thermal bank provides ability to draw heat out of the keg 22 more readily. The latency is built in to the cooling cycle in course of operating the dispensing apparatus 10.

The utilization of the ice storage cavity 62 of the thermal bridge 40 in the cooling system 34 boosts the ability of the cooling system 34 to lower the temperature of the beer 70 in the keg 22. The bridge 40 decreases the cooling time for the beer to a desired serving temperature offering benefits to the user. This is achieved by means of an ice store located in the aluminum block cavity 62. The ice is frozen by the Peltier device 36 once a keg 22 of beer is cooled in preparation for the next keg. The latent energy required in the phase change from water to ice is considerable. About 2kg of water, when frozen, has the capacity to absorb enough energy to cool 6kg of water by 20°C. When a new keg 22 is inserted into the dispensing apparatus 10, the new keg cools much quicker than by the use of a Peltier device and cooling fan alone.

Further, a good thermal contacting relation between the cooling solution 66 and the aluminum block cavity 62 provided by interleaved fins 76 and 84 ensures both rapid freezing of the ice and rapid thawing when cooling beer. This is achieved by using the elongated finned internal surfaces of the fins 76 and 84 in a manner similar to a heat sink.

An ice store of cooling solution 66 is preferably at 0°C when cooling the beer. However, there is a temperature gradient through the aluminum block cavity 62 and the ice store or cooling solution 66, when cooling, is colder than the cooling plate 64 by as much as 2 or 3°C. The differential between beer and cooling plate 64 temperatures is less than it could be if the cooling plate were at 0°C and cooling would be slower.

The Peltier unit 36 preferably is a 50W or 72W rated device. The Peltier unit 36 is preferably clamped between the heat sink 46 and thermal bridge 40 by using two stainless steel bolts (not shown).

The Peltier device 36 and fan 50 supply voltages are controlled so that when the beer is finally cooled to the desired serving temperature a lower rate of energy extraction is provided to avoid freezing the beer and to reduce energy consumption and noise. The use of Peltier device 36 and fan 50 preferably limits the cooling power to, at most, 50W and more typically 30W. The cooling of a 6 liter keg of beer from 23°C to 3°C by the Peltier device 36 and fan 50 alone typically takes 8 to 20 hours. The material of the keg 22 has an effect on this cooling time.

The rating of the heat sink 46 and fan 50 is better than 0.25°C/W. At an ambient temperature of 22°C, the heat sink 46 temperature measured adjacent to the hot side 44 of the Peltier device 36 is preferably not be above 35°C. The heat sink 46 is preferably made from extruded Aluminum. It need not be coated. The fan 50 preferably provides 29cfm (cubic feet per minute) at 12V supply. The fan is capable of starting at 6V.

The mediate thermal bridge 40 connects the Peltier device 36 cold side wall portion 60 to the cooler plate 64 underneath the keg 22. The temperature gradient between these two points preferably does not exceed 3°C at 40W flow.

The mediate thermal bridge 40 is preferably manufactured from cast aluminum alloy LM 20. This material has been chosen for its thermal conductive properties.

The cooling plate 64 to keg 22 interface is preferably matched to the form of a keg pressurised at 1.5 bar. The temperature differential

between cooling plate 64 and the keg bottom surface 64 (which is at 3°) shall be $<3^{\circ}\text{C}$ (i.e. the cooler plate 64 should be at a temperature of 0°C under these conditions).

While the preferred embodiments described in relation to the drawings are for a thermal bridge having a cavity located in heat transfer relation with the keg below the bottom portion of the keg, it should be understood that the thermal bridge may be located in other locations in heat transfer relation with the keg. One such other location, for example, is to locate the thermal bridge beside the keg in heat transfer relation to the side wall of the keg.

WHAT IS CLAIMED IS:

1. A cooling system for cooling a keg containing an alcohol beverage, the cooling system comprising:

a thermal bridge adapted to contact a surface portion of the keg and the thermal bridge having a reservoir filled with a cooling solution comprising a mixture of water and glycol; and,

a cooling device adapted to chill the thermal bridge, including the cooling solution in the reservoir, so as to produce a latent heat cooling capacity in the thermal bridge for cooling the alcohol beverage contained in the keg when the keg is mounted in heat transfer relation with the thermal bridge.

2. The cooling system of claim 1 wherein the cooling solution comprises 5% by volume glycol.

3. The cooling system of claim 1 wherein the cooling solution further contains corrosion inhibitors.

4. The cooling system of claim 1 wherein the solution is cooled to form ice.

5. The cooling system of claim 1 wherein the cooling device has a Peltier thermoelectric cooling unit that has a cool surface portion in heat transfer contact with the thermal bridge and that has a hot surface portion in heat transfer contact with a heat sink.

6. The cooling system of claim 5 wherein the cooling device further includes a fan for directing air flow across the heat sink.

7. The cooling system of claim 1 wherein the thermal bridge comprises a cooling plate adapted to contact a bottom surface portion of the keg.

8. The cooling system of claim 1 wherein the cooling device

further includes an active heat sink adapted to remove heat from the thermal bridge and to dissipate heat transferred through the thermal bridge from the alcohol beverage in the keg .

9. A home beer dispensing apparatus having a cooling system for cooling a keg containing beer, the cooling system comprising:

a thermal bridge adapted to contact a surface portion of the keg and the thermal bridge having a reservoir filled with a cooling solution comprising a mixture of water and glycol; and,

a cooling device adapted to chill the thermal bridge, including the cooling solution in the reservoir, so as to produce a latent heat cooling capacity in the thermal bridge for cooling the beer contained in the keg when the keg is mounted in heat transfer relation with the thermal bridge.

10. The dispensing apparatus of claim 9 wherein the cooling solution comprises 5% by volume glycol.

11. The dispensing apparatus of claim 9 wherein the cooling solution further contains corrosion inhibitors.

12. The dispensing apparatus of claim 9 wherein the solution is cooled to form ice.

13. The dispensing apparatus of claim 9 wherein the cooling device has a Peltier thermoelectric cooling unit that has a cool surface portion in heat transfer contact with the thermal bridge and that has a hot surface portion in heat transfer contact with a heat sink.

14. The dispensing apparatus of claim 13 wherein the cooling device further includes a fan for directing air flow across the heat sink.

15. The dispensing apparatus of claim 9 wherein the thermal bridge comprises a cooling plate adapted to contact a bottom surface portion of the keg.

16. The dispensing apparatus of claim 9 wherein the cooling device further includes an active heat sink adapted to remove heat from the thermal bridge and to dissipate heat transferred through the thermal bridge from the beer in the keg .

COOLING SYSTEM FOR ALCOHOL BEVEAGE DISPENSING
APPARATUS
ABSTRACT

A cooling system for a home beer dispensing apparatus has a mediated thermal bridge providing a bank of latent cooling capacity. The bridge is arranged in thermal conducting relation between a keg containing the beer and a Peltier thermoelectric cooling device adapted to cool the cooling solution by extracting heat therefrom to an active heat sink. The cooling solution comprises 5% by volume glycol and freezes at a temperature below that of water providing an improved thermal bank. The cooling system is economical in its space requirements and enhances the chilling of the beer to a desired serving temperature.

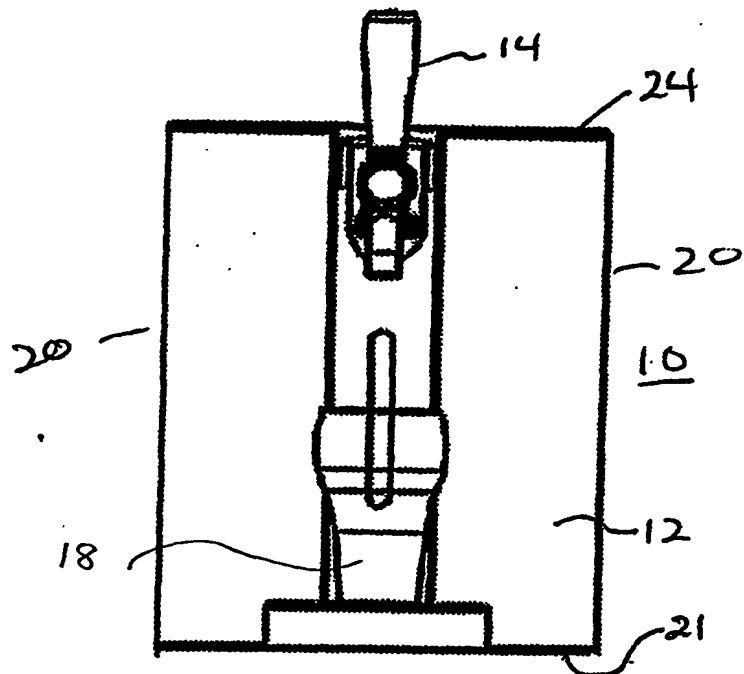


FIG. 1

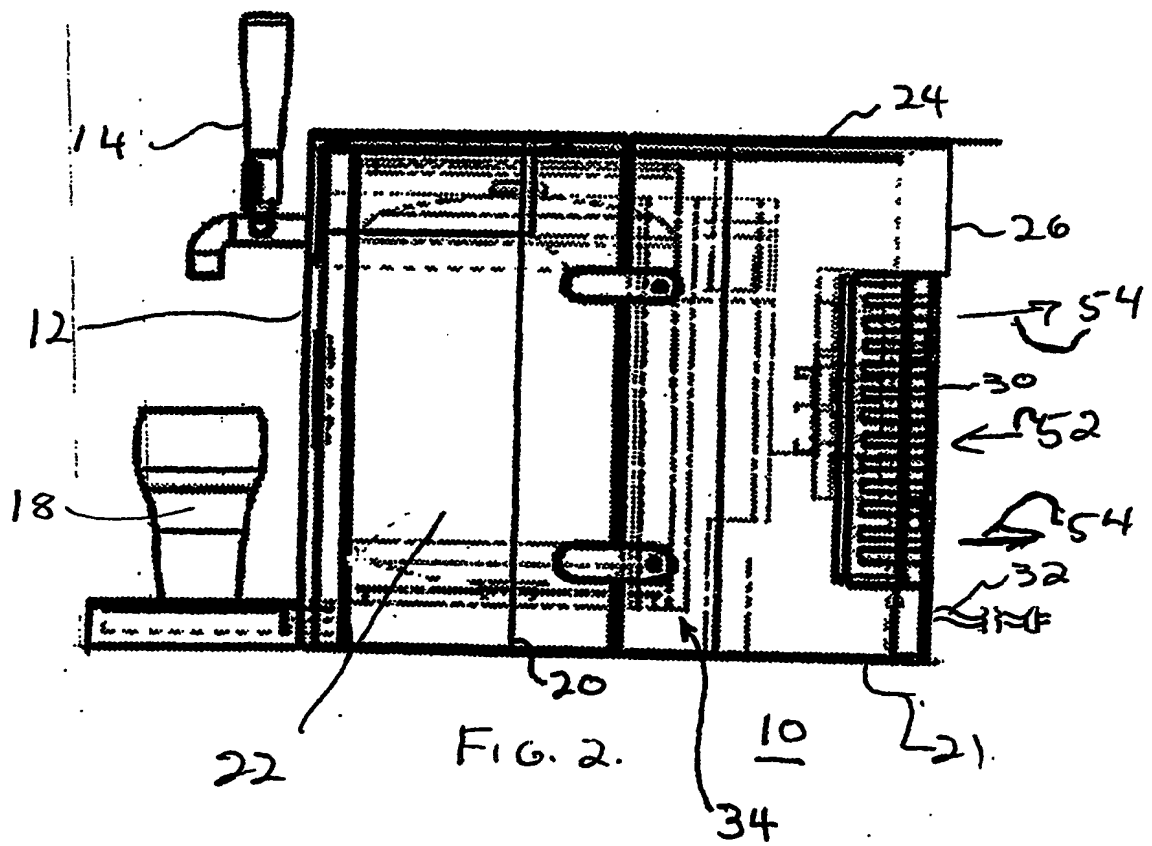
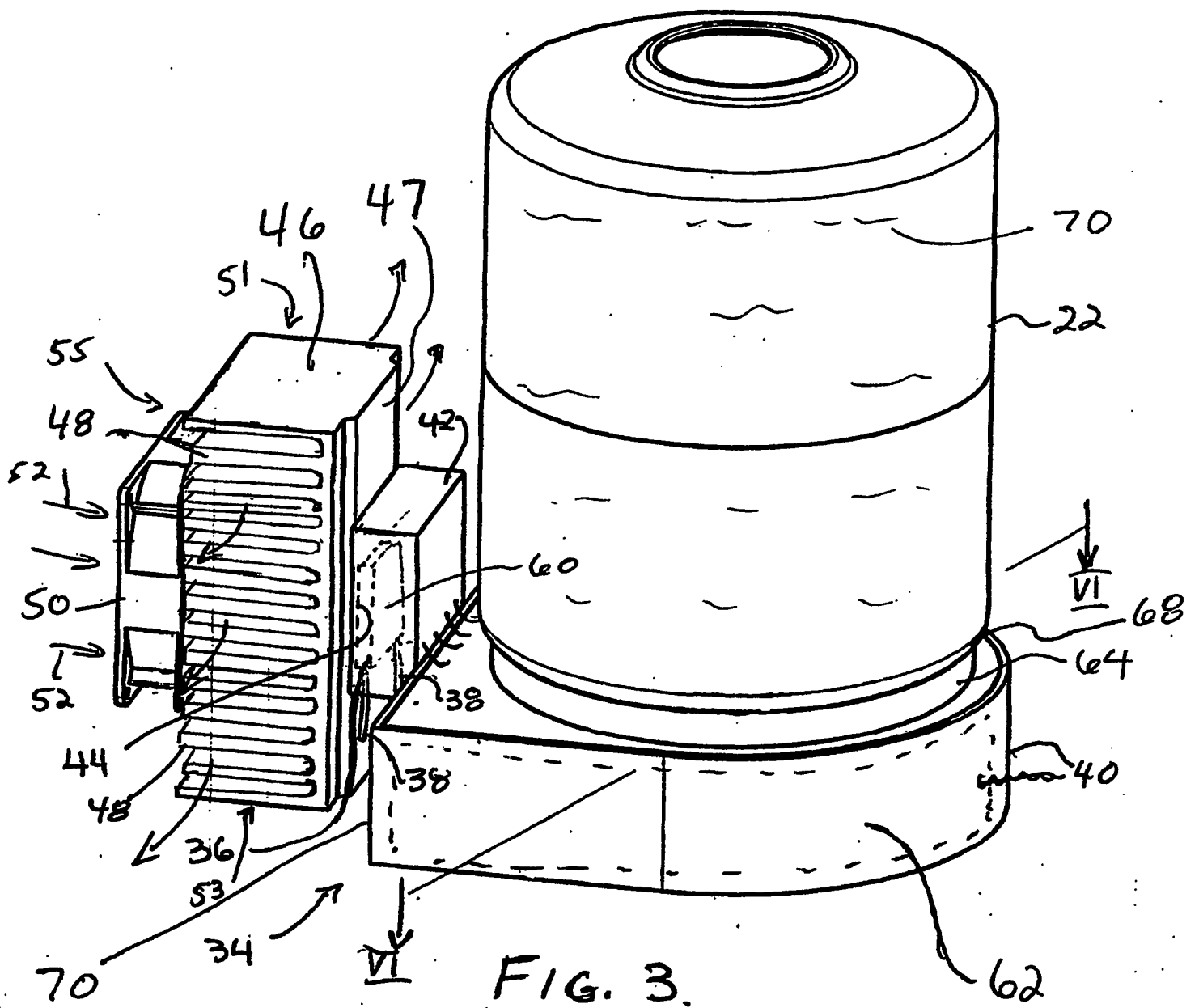


FIG. 2.



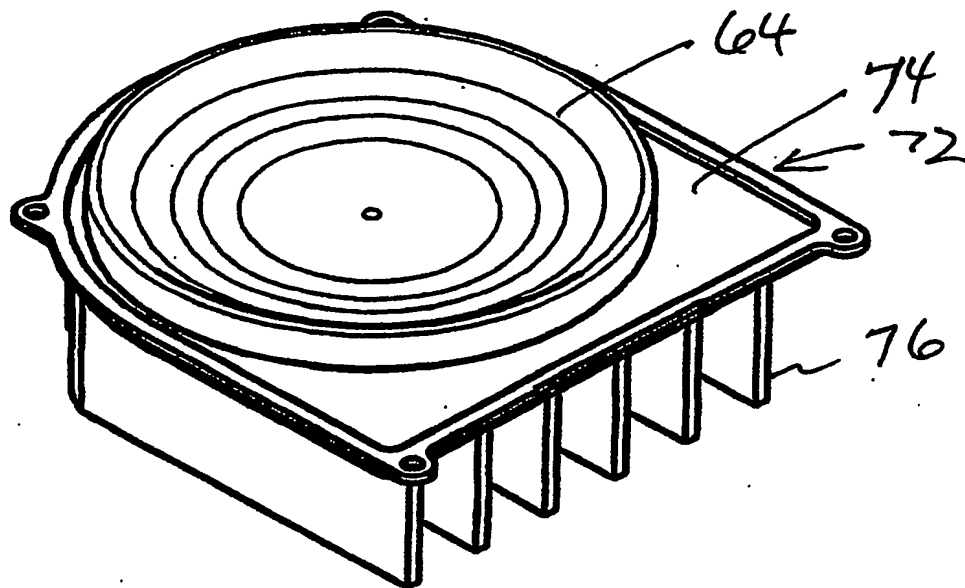


FIG. 4.

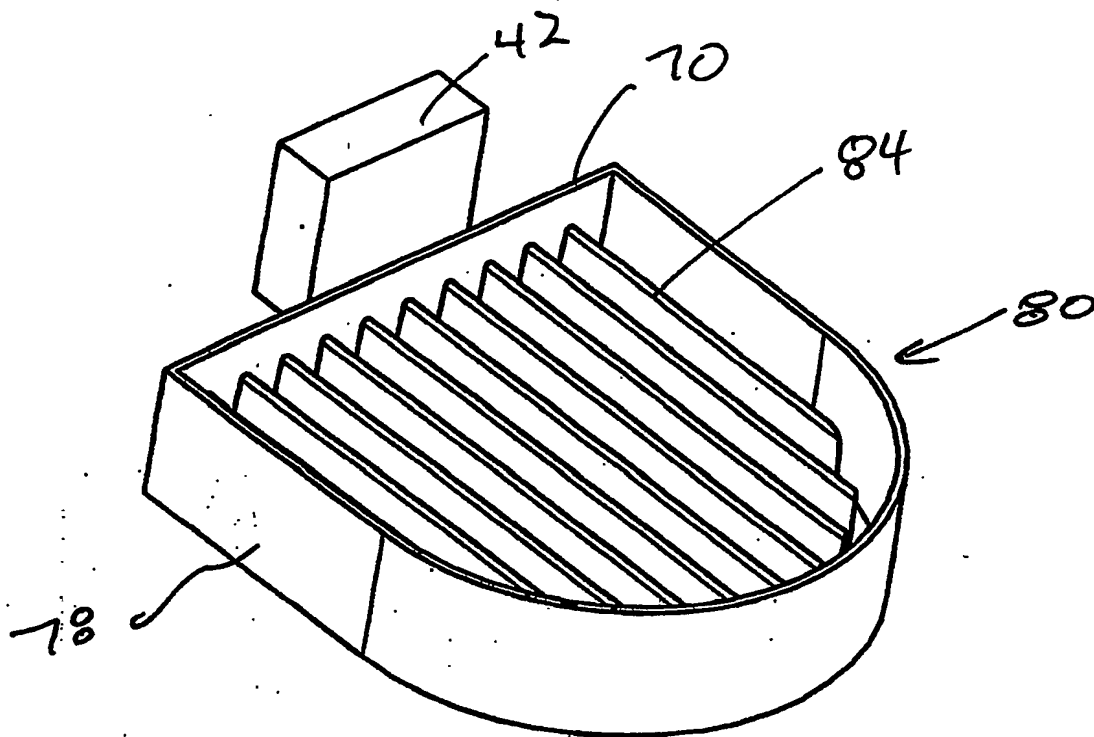


FIG. 5.

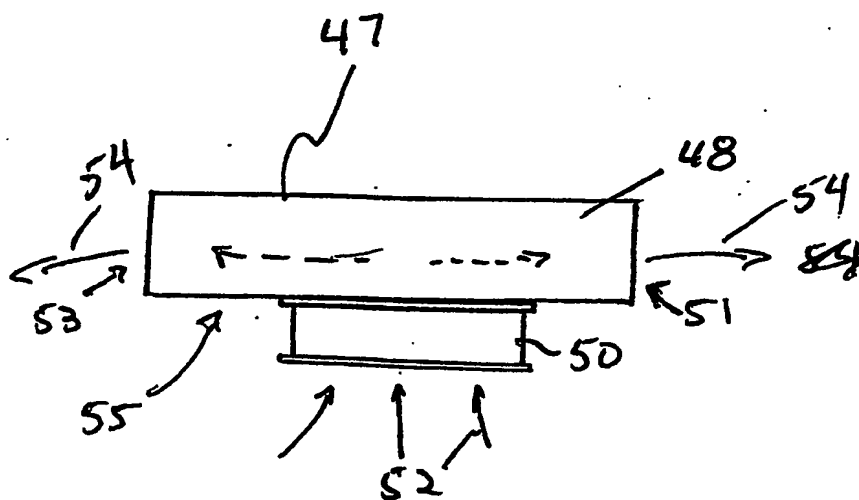


FIG. 7.

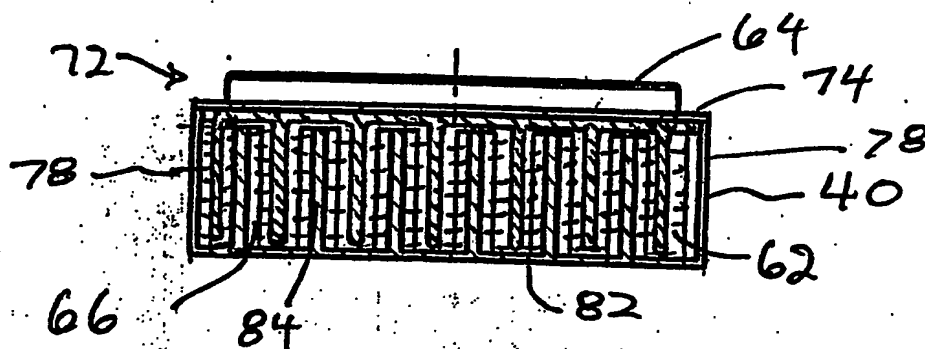


FIG. 6